The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLVII
No. 1226

SATURDAY, DECEMBER 26, 1942
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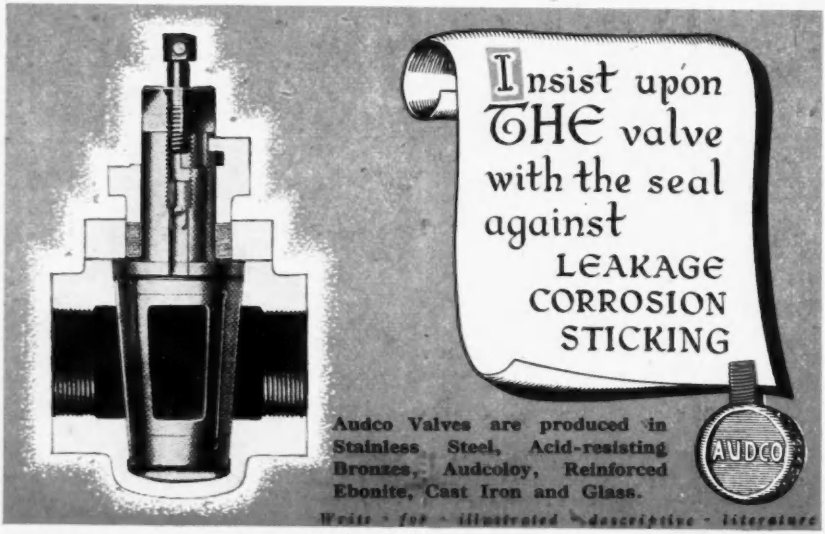

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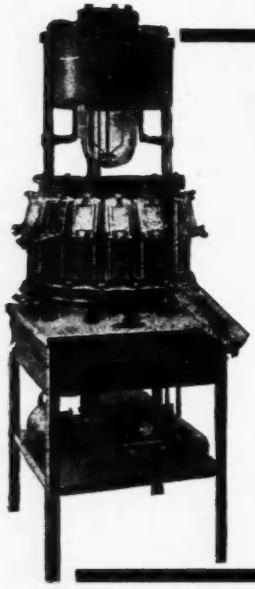

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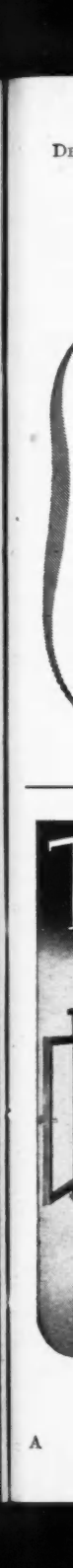

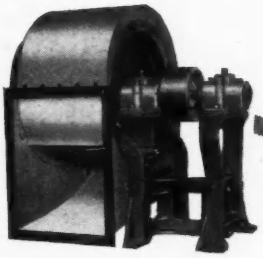

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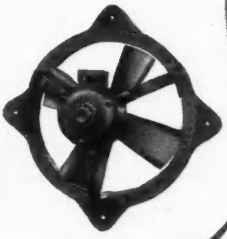

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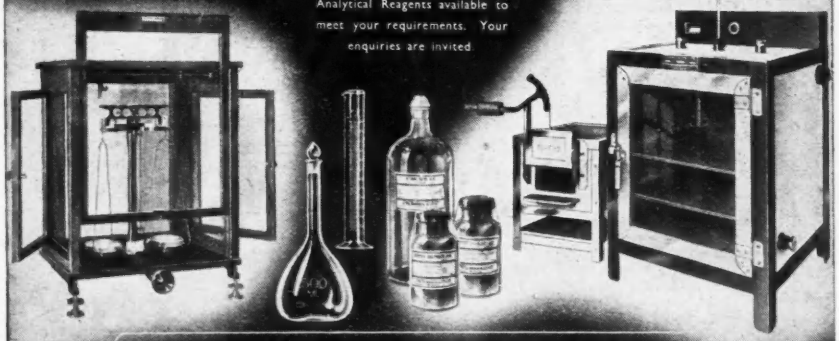

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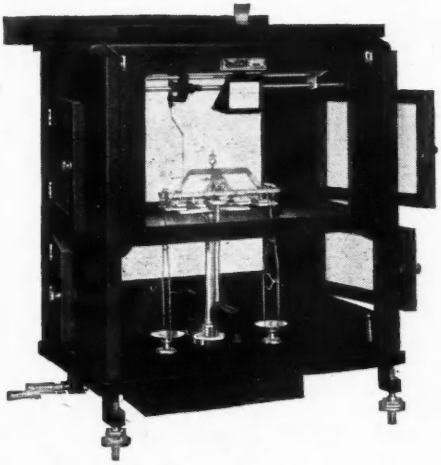

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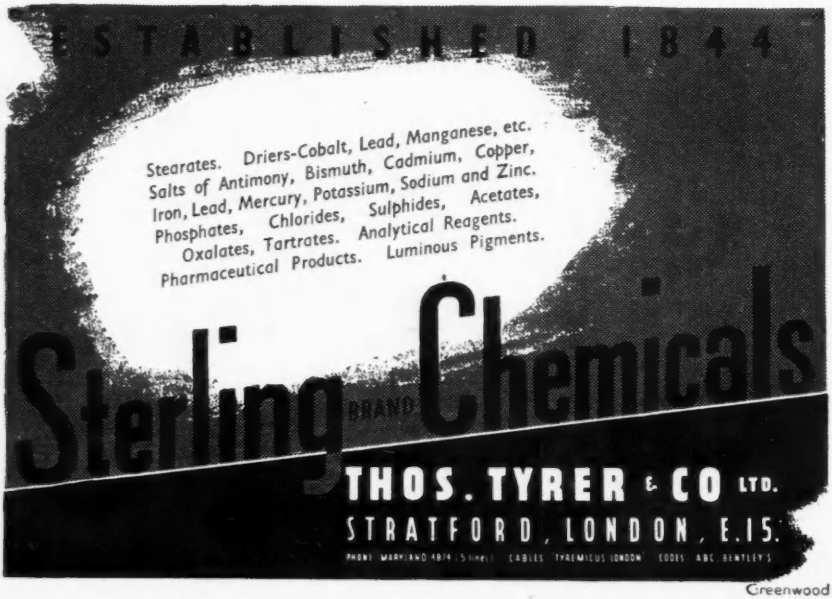
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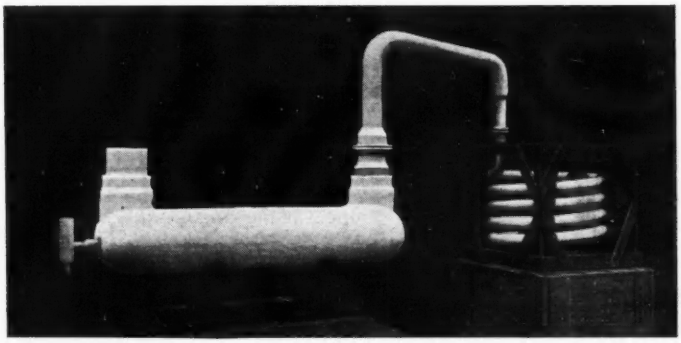

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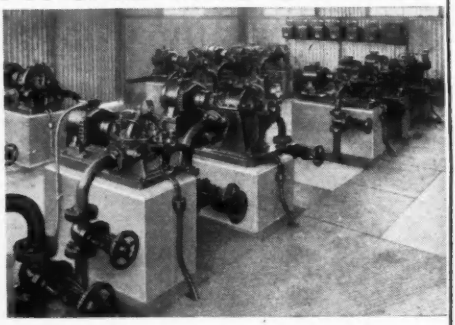

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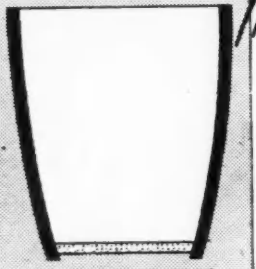

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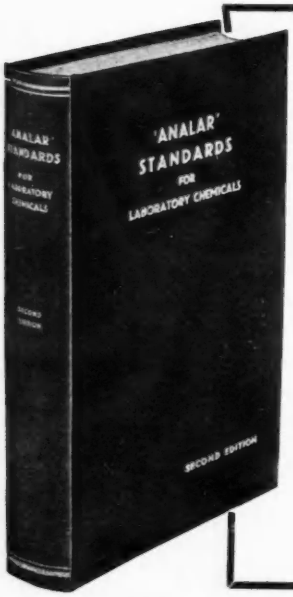

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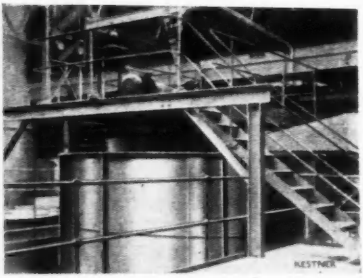

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Genius

ON Christmas Day, 1642, in a farmhouse at Woolsthorpe, near Grantham on the Great North Road, was born one whose fame will endure so long as science flourishes. Isaac Newton, judged by modern standards, knew comparatively little. With true genius he recognised his limitations: "I do not know what I may appear to the world," he wrote, "but to myself I seem to have been only a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me." Those who know most, most realise how little they know. To the the world, judging through the vista of 300 years, Newton appears not as one playing by the seashore, but as an outstanding voyager on that great ocean of which his genius recognised the existence. Wordsworth's well-known lines on the statue of—

". . . Newton, with his prism and silent face.
The marble index of a mind forever
Voyaging through strange seas of thought alone,"

more adequately expresses the judgment of posterity. He was the master mariner who set the course for the ship of science for centuries to come. We have based, and still base, our science upon Newtonian conceptions. The science of everyday life is still wholly Newtonian, even though the discovery that space is curved may result in some modifications. Upon the Newtonian science has been built the great edifice of discovery, invention, and industry that is the dominating factor in the world to-day.

To appreciate the greatness of Newton it is only necessary to consider oneself in a world of unsolved problems. Chemists are frequently faced with problems of which the solution defies them. Cancer and its cure, weather forecasting, life on other worlds, the nature of life and the beginnings of life, a source of fuel when our coal supplies have all been used, social problems such as the creation of a monetary system that will enable distribution to keep pace with production, the distribution of power by wireless—if in these and many other problems that now seem insuperable, there was one man who could indicate one by one how each could be solved, he would be acclaimed a genius indeed. Yet that would but be a parallel of Newton's achievement. Mankind, obsessed with preconceived ideas

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that had almost the force of religion and were often backed by religious authorities (as free-thinkers found to their cost), had groped in darkness for centuries. Pope's well-known couplet, which is carved in the bedroom at Woolsthorpe where Newton was born, says not more than truth.

Newton lived at a focal period in scientific development. Perhaps he *was* the focus of that period, and the reason why it came to have so much significance. The views of Aristotle had been virtually undisputed for centuries. Galileo, one of the first to think for himself and to express his doubts, died the year Newton was born. Descartes, too, just preceded him. Robert Boyle, Wren, Halley, Leibnitz, Flamsteed, Hooke, and many more giants of greater or lesser stature were Newton's contemporaries; mathematics flourished as perhaps never before. Newton himself specialised in mathematics, astronomy, geometry (regarded as a separate subject by the Royal Society of that day), and optics. He also became at the age of 53 Master of the Mint, thereby setting another precedent that has unfortunately continued to this day, namely, that those who desire or need money must pursue some vocation other than science. The result in Newton's case, as so often to-day, was that his great work was done at an early age, and his later years were comparatively barren of results. But he died worth £42,000—no inconsiderable sum in those days.

The spread of science and of the scientific habit of mind will have great effects upon the moulding of human character throughout the world. Men of genius and science have no boundaries. Their discoveries are not mutilated by translation, as is great literature. Theirs is the flux that can join nations now poles apart. Men of science may disagree in their interpretation of fact or even on the facts themselves, but they do not fight about it. Calmly they put warring theories to the test of experiment and from that test ultimately emerges the truth.

Newton was no isolated phenomenon. He was, as Sir James Jeans has said, "the concentrated embodiment of all distinguishing characteristics of British science." When British science loses those characteristics, then will come eclipse. Horace Walpole, in 1774, foresaw the spread of science and learning to those nations then regarded as savage and illiterate: "The next Augustan age will dawn on the other side of the Atlantic. There will, perhaps, be a Thucydides at Boston, a Xenophon at New York, and, in time, a Virgil at Mexico, and a Newton at Peru. At last, some curious traveller from Lima will visit England and give a description of the ruins of St. Paul's, like the edifices of Balbec and Palmyria." Science and learning have since spread across the Atlantic in full measure, but though curious travellers from Lima (or its equivalent) have lately given descriptions of the ruins of London, St. Paul's still stands. So also does British science and Britain's might. That they will stand is due in great measure to the scientific descendants of Sir Isaac, the men who design, build and operate the great factories where applied science turns out engines of war, and to the research workers whose discoveries enable us to keep abreast of the world.

That science knows no boundaries is a reason for maintaining the scientific tradition of Newton and his peers. If we think too much of social progress and too little of technical and scientific progress, Walpole's prophecy will come true in the literal sense that he meant it. We seem to be in danger of adopting grandiose social schemes that we cannot pay for, save by the usual process of "soaking" the middle classes. The middle classes are the backbone of scientific and technical progress. Let us beware that in building a new social order we do not throw away our heritage. It is only by scientific development, leading to industrial development, that we can put ourselves in a position to afford the daydreams of reformers. Lord Lytton once justly remarked that "castles in the air cost a vast deal to keep up."

Scientific and technical men have pursued and will pursue their ends with self-confidence because their feet have been set on the right path by Newton and his kind. It is through self-confidence and the courage of their convictions that Newton and all scientists have made and will make their discoveries, often in the face of discouragement and opposition: "To believe your own thought, to believe that what is true for you in your private heart is true for all men—that is genius."

NOTES AND COMMENTS

Multiple Factories

CONCENTRATION of industry in a style unfamiliar in this country has been put into practice in Stockholm, according to a note in the *Anglo-Swedish Review*. The city authorities have had a large factory, formerly belonging to the L. M. Ericsson telephone company, transformed into workshops of different sizes to accommodate about 100 small enterprises, some with a staff of twenty, some employing only two or three hands. In this multiple factory all manner of goods are manufactured, including accordions, screws, pens, printing ink, and women's hats. This form of concentration, so far from killing the "small man," actually promotes his efforts without encouraging the uneconomic system of casual dispersal. If the scheme is a success and appears to satisfy a need, further disused factories will be fitted up in a similar way. It is a point worth considering for after the war in Britain, where there will surely be a number of factories that will not continue to be operated as they are at present; it certainly offers a suggestion for fostering that spirit of private enterprise which is widely claimed to be the foundation of our industrial greatness.

The Chemist Turns Engineer

WHAT does the young chemist expect from industry when he leaves his university and embarks on a career? If it is adventure he seeks, he may go into the new, or quickly developing, industries such as modern metallurgy or plastics. On the other hand, there is still, apparently, much scope for initiative in the work which goes on—less glamorously—in the back rooms of our older industries. Dr. A. E. Haffner, himself a chemical engineer on the staff of a big gas undertaking, said at a recent meeting that the policy of permitting the research worker in his own industry an undisturbed atmosphere for work had been most productive. He complained, in fact, that research had been left almost exclusively to the chemist. Where the problem to be tackled had had engineering aspects, the more versatile chemists had been able to modify their outlook. Apart from what he called "this chemical overflow," engineering research had been neglected.

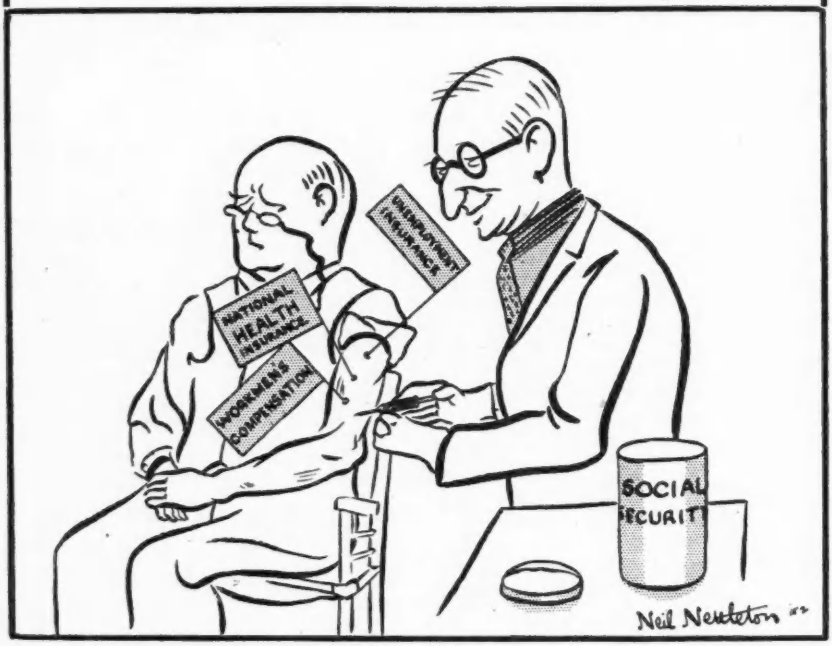
Neglected Problems

WHILE paying tribute to the work of the chemist in his industry, Dr. Haffner thought that there were problems of metallurgy, hydraulics, and mechanics which required specialist approach. Who in the industry, he asked, was working on gas turbines? Who was applying polarised light technique to the study of mechanical strain in gasworks plant? Were the rapidy developing researches in aerodynamics being applied to exhausters, boosters, and fans? On whom did the industry rely for its problems in heat transmission? Had the industry got its own facilities for the X-ray examination of welds? Nobody in the subsequent discussion was emboldened to answer Dr. Haffner's pointed questions. Certainly the chemist could not be expected to cope with these matters of close concern to the engineer. If chemists need the help of other specialists in furthering the development of an industry, then they should have it. Lack of such co-operation is a hindrance to progress; and it is a poor reward to the man in the laboratory for his initiative and perseverance.

Wholesale Prices in November

TRENDS manifested during the last few months were again maintained in the wholesale prices of chemicals, metals, and the like. Iron and steel, with a Board of Trade Index Figure of 182.7 (1930 = 100), and non-ferrous metals, at 126.0, have shown no change since April and June this year respectively. The price of chemicals and oils on the other hand, still continues to rise, and the November figure is 142.0, as against 141.5 in October (a rise of 0.4 per cent.), and 129.2 in November, 1941 (a 10 per cent. rise). The overall rise in the prices of industrial materials and manufactures during the month under review was only 0.1 per cent. Highest percentage rises in the chemicals and oils group were recorded for quinine sulphate (7 per cent.) and phenolphthalein (6½ per cent.), but each of these commodities has a weight

"N_2O" by Neil Nettleton



INOCULATION

Industrial Chemist: I don't know whether it will "take," Sir William!

of no more than one-fifth of a unit is the sub-group for drugs. The only group is the industrial materials and manufactures section that is now comparable with chemicals, in respect of price-increase, is coal, which registered a rise of 10.6 per cent. in price in July last.

More Waste Paper Needed

ONE of the lessons of successful total war is to achieve the normally impossible and to be "on one's toes" all the time. The call for waste paper strikingly emphasises this. At the beginning of the first big organised demand, a year ago, the whole community, inspired by mixed motives of patriotism and a really good reason for stopping to clear out old accumulations worth their weight in gold to the forces, made a magnificent response. Tonnage of salvage paper shot up. Now the drive has slackened. True, there is less paper, but there is still a lot. Bus tickets that might help to take the enemy on a longer journey than to Misurata again make their appearance on floor and kerbstone. Cigarette packings, once taboo in the best travelling circles, again adorn the floors and seats of railway compartments. There is a vast field for economy and useful work in saving paper, and it is really very little trouble. Readers, see what you can do to restore the paper salvage situation in your factories, offices, warehouses, and homes. The fighting men need one hundred thousand tons now. If everyone tries hard it can easily be obtained.

Season's Greetings

WE take the opportunity, having a few lines to spare on this page, of wishing all our readers a reasonably festive Christmas, and a prosperous and active year in 1943. It is our fervent hope that the enterprises of industrial chemistry may soon once again be turned towards the goal for which they are primarily intended.

Industrial Lubricants

Some Notes on Recent Research and its Applications

by G. S. COLLINGRIDGE, B.Sc.

THE wheels of war revolve with ever increasing velocity. Production lines work night and day without remission. Never before in this country was such a great strain imposed upon existing plant and equipment. The tremendous importance of lubricants cannot, therefore, be over-estimated. In the course of recent research on this subject I have compiled the following notes for my own guidance, and I trust that they will also prove useful to other chemists engaged in modern lubricant manufacture.

Theory of Boundary Lubrication

Generally speaking, two major types of lubricant are recognised, namely, boundary and fluid lubricants. Boundary lubrication is the effect caused by extremely thin films of oil between two surfaces. According to Hardy, the re-orientation of molecules in the adsorbed film of oil has been shown to involve a time lag of up to 60 minutes before the attainment of minimum friction is realised. Langmuir affirms that these molecules are probably of a fatty acid character, oriented so that the hydrocarbon chains stand out from the surface. On the practical side, Wells and Southcombe first claimed that as little as 1 per cent. of fatty acids in association with mineral oils gave as good results as more conventional mixtures of mineral and vegetable oils. Fatty acids also promote improved spreading and penetration, due to the lowering of interfacial tension.

Recent theories of boundary lubrication have led to some highly significant investigations into the actual *modus operandi* of lubricating oils. Manufacturing chemists who are not merely content to modify existing formulæ and make empirical additions to standard products, would be well advised to study the work of Mougey and Almen[1] and of Simard, Russell, and Nelson.[2] These latter workers carried out their investigations on extreme pressure lubricants under the joint sponsorship of the Atlantic Refining Company and the Battelle Memorial Institute; assistance was also accorded them by General Motors Corporation—a fact that lends added interest to their conclusions.

The mechanism of lubrication is not yet well understood. It is, however, generally conceded that the essential requirement is to produce and maintain a film which will prevent the intimate contact and the consequent welding together of opposed metal surfaces. Although experiment has shown that oiliness and film strength can be enhanced by the addition of chemical substances to oils, the diversity of such additions makes possible but few generalisations concerning the physical and chemical nature of the films that they form. Chemically active additions are believed to react among themselves and the bearing surfaces to form adherent films. Less chemically active, but highly polar additions are believed to form adsorbed molecular layers at the oil-metal boundary, whose properties are determined both by the polarity and internal structure of the molecules.

Extreme-Pressure Lubricants

The application to powerful "extreme-pressure" lubricants of electron diffraction methods of surface analysis has recently led to certain revealing and significant conclusions. Thus the investigation of the film-forming action on metal surfaces of lead naphthenate and free sulphur in highly refined and commercial base oils, by electron diffraction, has shown :

1. The effect of base oils appears to be limited to their action as oxygen carriers or to possible interaction with the addition agents. Lead naphthenate plus free sulphur additions showed greater film-forming tendency in unrefined than in highly refined oils.

2. Oils containing free sulphur formed oxides or hydrates on iron surfaces under both static conditions at 150° C. and friction conditions at high or low loads.

3. On all metals lead naphthenate oils formed, under static conditions, adherent films shown to contain lead. No characteristic phases were observed.

4. Lead naphthenate plus free sulphur oils on iron, under laboratory friction

conditions and simple heating at 150° C. or below, seemed to form an initial layer of lead sulphate with a super-imposed layer of lead sulphide appearing later. At 300° C. lead sulphide, with possibly only a trace of dispersed lead sulphate, was observed—showing that the layered structure does not form at higher temperatures.

5. The examination of hypoid gears run 20,000 miles exclusively in lead naphthenate plus free sulphur lubricant revealed mainly iron oxide.

6. The appearance of iron oxide and lead sulphate shows that oxygen must be included in considering the chemistry at extreme-pressure lubricants.

Tests of E.P. Lubricants

Back in 1929, a very well known roller-bearing company had problems in steel-mill gear operation which were solved by the use of extreme-pressure lubricants.[3] The types used then were the lead-soap and lead-soap-sulphur compounds, and also a mineral oil to which had been added from 15 to 20 per cent. of a sulphur-chloride base oil. The last mentioned compound produced some discoloration, but apart from this, these lubricants gave quite satisfactory results. Some steel-mill operators feel that the lead soap has a cushioning action and will lessen gear noise. The first lead soaps made, using lead oleate, had a tendency to separate; but this has been overcome by the use of lead naphthenate to replace the oleate.

When and why should E.P. lubricants be used for gears? The principal application would be where gear teeth are subjected to very heavy loads. Here a mild E.P. lubricant is used to avoid possible scuffing, or excessive wear, and abrasion. The lead-soap compounds, according to some, give additional protection against pitting. When ordinary straight mineral oils will not do the work, these special lubricants may prove satisfactory. Gears that run hot are often a cause of complaint. This heating may be due to using an oil of too high a viscosity, in which case the remedy is obvious. But if it is due to overload, the use of an E.P. lubricant may allow cooler operation, as well as reduce the wear on the gear teeth.

The field of E.P. lubricants available for all purposes includes the following classes:

1. Mineral oil + lead soap + active sulphur compound.
2. Mineral oil + lead soap (with natural sulphur compounds in the base oil).
3. Mineral oil + lead soap + inactive sulphur compound + chlorine compound.
4. Mineral oil + active sulphur compound + chlorine compound.
5. Mineral oil + inactive sulphur compound + chlorine compound.
6. Mineral oil + active sulphur compound.
7. Mineral oil + inactive sulphur compound.
8. Mineral oil + chlorine compound.
9. Mineral oil + phosphorus compound.
10. Mineral oil + chlorine compound + sulphur compound + phosphorus compound.

Almost all these types contain, in addition, some saponifiable oil.

An ideal E.P. lubricant has been said to possess the following properties: (1) high enough E.P. value to carry the desired load; (2) low abrasive action; (3) low chemical activity; (4) high stability; (5) high fluidic properties. Stability is most important, and on this point many E.P. lubricants vary widely. They may oxidise rapidly and thicken, but there are also cases where they have given ten years of service. Some may become highly acid and corrosive or rancid at high temperatures. Others may suffer a loss in load-carrying capacity, or may become highly abrasive, or even break down entirely and carbonise. The sludging of oil is a good indication of lack of stability.

Cutting and Tapping Lubricants

Cutting-oil lubricants are employed for lubricating tools for cutting metals. They should possess high specific heat, fluidity and lubricating properties. Fatty oils such as rape and lard are good, even though they are frequently associated with an unpleasant odour when in use. Modern "compounded" mineral oils have in many cases replaced the older types of cutting oil, however. To improve lubrication, additions are made, such as fatty oils, sulphurised lard oil, chlorinated fractions, etc. Sulphonated castor and fish oils are also employed in this connection.

It is nowadays widely considered that

the finish obtained with an emulsified or "solubilised" cutting oil is usually superior to that which results from the use of a straightforward cutting oil. Bassett[4] and others have observed that soluble cutting oils may consist of mineral oil, an animal or vegetable fatty oil *e.g.*, tallow, lard, or castor oil), and an emulsifying agent such as soap, sodium naphthenate, or Turkey red oil. These compositions mix with water to give reasonably stable milky emulsions. Owing to the risk of dermatitis, a little antiseptic is often added. When dilution takes place, soft water is best utilised, although the addition of 0.5 to 1 per cent. washing soda may be recommended, when hard water only is available.

Prospective manufacturers of tapping and cutting lubricants would do well to note the following recommendations made by a well-known American tap and die corporation (Table I):[5]

TABLE I

MATERIAL UNDER TREATMENT.	TYPE OF LUBRICANT.
Allegheny metal	Sulphur base oil
Aluminium	Kerosene and lard oil
Bakelite	Dry
Brass	Compound or light base oil
Bronze	Compound or light base oil
Copper	Light base oil
Die castings, zinc	Compound oil
Iron, cast	Dry, or compound oil
Iron, malleable	Compound or sulphur base oil
Monel metal	Sulphur base or kerosene and lard oil
Nickel silver	Sulphur base or kerosene and lard oil
Steel, various types	(1) Sulphur base oil (2) Kerosene and paraffin (3) Kerosene and lard oil (4) Compound oil.

Universal Gear Lubricants

Recently, a proposed U.S. Federal specification for a universal gear lubricant has been drafted, covering all the U.S. Government applications for motor-car and industrial uses. First a mixture is made containing between 70 and 80 per cent., by weight, of chlorinated paraffin wax (40 per cent. chlorine), the remainder being either dibenzyl disulphide or chloronaphthyl xanthate (30 to 35 per cent. chlorine). Then the E.P. lubricant is made by blending 10 per cent. of this mixture with 90 per cent. of mineral oil, by weight. Such a lubricant would not be classed as the powerful hypoid type, but would be one of the milder types. The two compounds could be mixed without causing any harm—something that is not true of the majority of E.P. lubricants.

Some engineers who have had broad experience with E.P. lubricants advocate the lead naphthenate type as having given satisfactory service in the past, and therefore hold the view that it is the only one to be considered at present. They state that every mill drive they have built in the last ten years has used either a lead oleate or a naphthenate lubricant. In practically all these instances, the lubrication system was designed to use this type of compound successfully. Other mill builders, in the heavy-duty field, consider that lead naphthenates should be used because of the protection they afford under emergency conditions, and because, where space limits the size of the gears chosen, much longer life is obtained. The newer types of lubricant may have possibilities, but most engineers prefer not to use them until a good record of field service has been established for them. Some engineers favour lead-sulphur and sulphur-chlorine, as well as straight sulphur-type oils.

For the purpose of wire drawing, sodium soaps are often regarded as satisfactory lubricants. Olive foots soap, tallow and palm kernel soaps, and various other kinds and grades have been used. As a lubricant for drawing and spinning stainless steels, a mixture of equal parts of lithopone and boiled linseed, thinned with kerosene and contain-

ing also talc or flowers of sulphur, has been advocated.

Lubricating greases vary considerably in constitution, but may well consist of approximately 70-90 per cent. fatty or mineral oil, 7-20 per cent. soap, and about 4 per cent. water. The soap in this and other cruder lubricants may be prepared from low-grade greases, garbage or sewage fat, etc., together with a proportion of resinates. Graphite, up to 20 per cent., is added to cup greases.

There is, of course, a very considerable range of industrial lubricants in existence, yet from the thinnest oils used for the most delicate machinery down to the heaviest greases and extreme pressure-resisting lubricants, one cannot fail to observe the universal utility of mineral oil. Apart from their stability, mineral oils normally possess a marked economic advantage, but all hydrocarbons usually require the addition of polar components to promote reorientation at the boundaries and a consequently improved performance.

Readily oxidised or stearine-depositing oils are obviously objectionable. In addition to mineral oils, castor, olive and deacidified sulphur oils are used; also palm oil, tallow, oleo and lard oils, neatsfoot, rape, bone, sperm, dolphin and porpoise-head oils, etc.[6] Castor oil, owing to the fact that it combines high and stable viscosity with low cold test, low solidification point, and minimum carbon residue, is particularly valuable. It is not, of course, completely miscible with mineral oils, but a blend of 9:1 castor and petroleum oils has been successfully employed for lubricating aero engines. By admixture with another fat, more mineral oil may be worked into the blend; mineral oil—soluble products are also obtained by treatment of castor oil. Lubricating oils are commonly thickened by blowing with air or by the addition of metallic soaps.

Simple Tests

Five simple tests, proposed by W. F. Schaphorst for determining the comparative values of lubricating oils for journals that require staying power, film strength, and efficient transmission, are as follows. Tests Nos. 1 and 2 demonstrate staying quality, No. 3 shock resistance, and Nos. 4 and 5 lubricating value. In performing these tests no laboratory equipment whatever is required.

(1) Dip thumb and forefinger into the lubricant. Open and close the finger and thumb and note how the oil adheres. Its adhering property is an indication of whether or not it will run out of bearing. Adherence is desirable in many bearings.

(2) Place equal-sized drops of two oils having the same viscosity on a glass plate. Tip the plate to a nearly vertical position. The oil showing the greatest resistance to flowing down the plate is preferable.

(3) Place on a steel plate equal-sized drops of two or more oils having the same viscosity. Hit each drop with a hammer and note how the oil is flattened out and splatters. The oil that does not splatter is preferable because it is most likely to prevent metal-to-metal contact under severe shock loads.

(4) Place a small quantity of the oil in the palm of the hand and rub vigorously. A thin clear film should adhere to all surfaces touched and should not be rubbed away. There should also be an absence of friction heat.

(5) Place the lubricant in an open-mouth jar. Dip a wide piece of metal or cardboard into the oil and then lift it above the jar to a height of from 12 to 18 inches and note the film. The broader the jar and piece of metal, the broader will be the film. Ordinary mineral oils subjected to this test will flow from the plate rapidly and splash and spatter. A first-class lubricant will flow off in the form of an even film and will not splash.

Users of extreme-pressure lubricants should be warned of the inadvisability of mixing the various types and brands. The chemical composition of each is different, and it is highly probable that mixing will produce a chemical reaction with resulting sludge or other undesirable features. If a change is to be made to a different type of lubricant, it is essential that the gear-box or housing should be thoroughly drained and flushed. Most E.P. lubricants emulsify when churned with moisture. Therefore they should not be used when there is any possibility that moisture may get into the gear-box or housing, or where extremely high humidity exists. Their use is not recommended in the presence of bronzes or other copper alloys.

High-grade oils usually employed in circulatory systems cannot be worn out

in the sense that their lubricating properties are destroyed; but metallic oxides, dust, or grit, held in suspension, may render them unfit for further service in that condition. They should not be thrown away, as their continuous re-use is possible if the impurities are removed by some process of purification. It must be borne in mind that the mere filtering of an oil from a circulatory system may not necessarily restore the oil to a condition which will prevent emulsification with water or the further deposition of sludge, and periodic tests are the only satisfactory means of determining its condition.

"Soluble Oils"

Here are some advertising claims made for a well-known American "soluble oil": "Highly sulphurised, high production oil. Emulsifies so readily, even in hard water, that no special mixing equipment or softeners are needed. It does not separate or gum machines or oil lines. . . . Gives longer tool life and better rust protection, because the oil stays evenly distributed throughout the emulsion."

One type of soluble oil is prepared by heating together, for a short while at 200° C., 80 parts by volume of spindle oil, 10 parts of castor oil and 10 parts of chlorinated paraffin (30 per cent. chlorine). Castor oil has also been rendered soluble in mineral oil by heating in vacuum in the presence of iron salts,[7] and by treatment with acid halides of phosphorus at temperatures below 100° C.[8] Work has also been carried out on the hydroxylation of soya-bean oil to impart lubricating and drying properties similar to those of castor oil. One investigator tabulated the physical and chemical properties of such products prepared by oxidising with hydrogen peroxide and with air while in glacial acetic acid solution.

Some Patents

A patented cutting oil composition consists of:

Glyceryl monostearate	75 g.
Sperm oil	150
Sodium salt of sulphonated oleyl alcohol	50
Water	1200

The constituents are warmed together and vigorously mixed.[9] An unpatented formula for a cutting oil may consist, for example, of 20 parts bone-fat fatty acids, 5 parts oleine, 63 parts refined spindle oil, and about 12 parts caustic soda lye (240° Bé.)

A metal drawing lubricant covered by B.P. 467,050 consists of the undermentioned ingredients melted together and mixed thoroughly:

Tallow	128 g.
Mineral oil	64
Soap	1
Colloidal sulphur	6
Colloidal graphite	1

Among the published formulæ for roller-bearing lubricants is one consisting essentially of a 5 : 1 mixture of sodium and calcium stearates, in association with 65 to 85 per cent. of light lubricating oil. The utility of lead soaps and sulphur in this connection must not, however, be overlooked. U.S.P. 702,197 protects a composition containing:

Sodium stearate	14.5 parts
Sodium naphthenate	6.9
Medium heavy mineral lubricating oil	77.89
Caustic soda	0.32
Water	trace

According to E. E. Halls and others, the presence of fixed fatty oils is required in deep-drawing lubricants, because of the great improvement thus effected in wetting, adhesive and film strength properties. Mineral-filled soap base compounds are recommended.

U.S. P. 2,257,359 refers to what may be briefly referred to as a bakelite bearing lubricant. It covers a method of lubricating composition bearings of the phenol-formaldehyde resin type, and consists in applying to the journal surfaces of such a bearing during active use of the latter a liquid composed principally of water and having uniformly dispersed therein minor percentages of a wetting agent or soap. Lubricating compounds containing halogenated foots oil and halogenated tall oil are protected by U.S. PP. 2,264,319 and 2,262,809 respectively.

During the past year or so, hydrocarbon lubricating oils were improved by the addition of small amounts of tri(*p*-lauryl phenyl) phosphate (Ries: U.S. P. 2,237,632), a combination of lecithin and triphenyl phosphite (Musher: U.S. P. 2,223,941), a condensation product of aromatic compounds and fat acids (Prutton: U.S. PP. 2,223,127-30) or a symmetrical diphenylethylenediamine compound of a halogenated fat acid (Musselman: U.S. P. 2,254,490).

Patented grease formulæ contained insoluble metallic soaps (Schott and Churchill: U.S. P. 2,253,399), rosin soap and soda soap of hydrogenated fish oil, fat acid pitch (Brunstrum and Swenson: U.S. P. 2,229,368), and sulphurised or chlorinated fat acids (Davis: U.S. P. 2,236,896-7). Aluminium soaps for use in greases were prepared by saponifying fat acids with aluminium hydroxide in the presence of hydroxides or carbonates of potassium, sodium, or ammonium (Boner: U.S. P. 2,267,148). U.S. P. 2,059,567 refers to the prevention of sludge formation in lubricating oils, by the addition of 0.1 per cent. of tin oleate or tetra-ethyl lead or 0.4 per cent. of chromium oleate.

This is not the place to discuss the recovery of lubricating oil by means of filtration, centrifuging, or chemical treatment. It should, however, go without saying that, in these carefully organised times, maximum use must be made of raw materials (even those of inferior grade), while finished preparations must likewise be very carefully conserved and, wherever possible, efficiently recovered and re-utilised.

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Coal Research Scheme

£1,000,000 Joint Development Project

THOUGH paling into comparative insignificance as regards cost beside the daily expenditure on the war, the new Coal Research Scheme announced last week by Sir Evan Williams, president of the British Coal Utilisation Research Association, provides for the largest and most lavish research organisation yet sponsored in this country. It is planned to spend no less than £1,000,000 over the next five years in the expectation of revealing new processes for the better use of coal as a raw material and for the creation of important by-products. A fund is being created from which £200,000 a year will be spent for the next five years. Of this the Government is paying £50,000 annually, the Mining Association £80,000, and the balance of £70,000 a year is to be borne by manufacturers of coal-using plant and equipment. A condition of the Government financial grant is that the results of the research shall be open to the whole country.

Sir Evan described the plan as " the most important joint research project ever undertaken by an industry in any country for the development of a basic raw material."

Full details of current developments and of the lines on which research is to be conducted must remain secret. Probabilities visualised which can be mentioned are:

(1) An increase in the potential energy of raw coal for domestic heating and industrial uses from the present 30 per cent. to 45 per cent. This would be worth £60,000,000 a year to the country.

(2) Increases in the by-products, including oil, plastics and chemicals, which at present number about 4000.

(3) Development of new standards of heating and cooking in private houses which, besides increasing efficiency, will reduce the amount of smoke by about five-sixths of the present volume.

Efficiency in converting coal into heat and power has risen from about 15 per cent. in 1913 to 30 per cent. just before the war, but a 45 per cent. standard is considered to be attainable and will be aimed at. Moreover, apart from the saving in cost that can be compassed by greater efficiency, it is obvious that more complete utilisation in combustion will release greater quantities of coal for other purposes. As sir Evan pointed out, the world's petroleum resources would be exhausted sooner or later, or would become so expensive to work that liquid fuels from coal would be demanded to meet the ever-increasing needs of the internal-combustion engine. Apart from this, larger and larger amounts of coal will be required for new raw materials, which it is proposed to increase both in quantity and in range. Already something like 4000 coal products are used in the chemical industry, and large quantities of these are being supplied. Oil from coal is high on the list of new developments, as is the range of products needed for the plastics industry.

In the research for industrial purposes the scheme will provide for close liaison with the Fuel Research Board of the Ministry of Fuel. The joint research body to be set up will represent every coal-using interest in the country.

Chemical Utilisation of Wood*

Source of New Raw Materials for Many Industries

SCIENCE has marked the way to fascinating transformations which add greatly to the importance of wood as a resource of our developing civilisation. Chemical conversion of wood adds high values to the raw material and, in general, does not produce wood substitutes, thus having no detrimental effect on the consumption and price of timber. Technical research work over a number of years shows that wood is a potential source of chemical raw materials which may far outstrip coal, petroleum and mineral resources in future utility. The forests—producers of cellulose and lignin—may be cropped several times in a generation and yield a much larger total of industrial material than at present. Wood waste lost during manufacture and use, amounting to nearly two-thirds of the entire forest drain, estimated at more than 300 million tons yearly—of which more than 100 million tons are readily available at very low cost—offers another incentive for the chemical utilisation of wood.

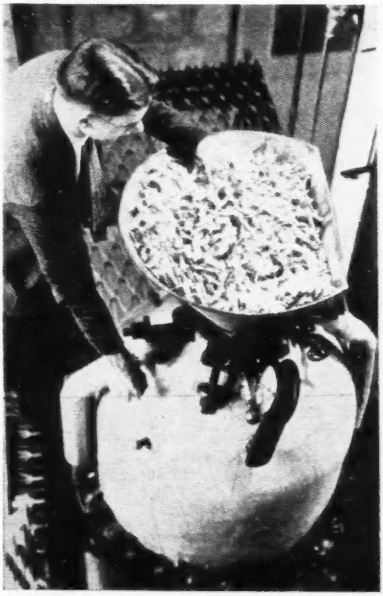
The Future of Wood

The future may see a large development of the use of wood as a source of fuel for internal-combustion engines. One method is to convert wood into alcohol; another, used extensively in Europe, is to convert wood into a gas in a special unit, which is then fed directly to the engine. About 20 lb. of wood are equivalent to one gallon of liquid fuel. Owing to the difficulty in transporting petrol and fuel oil, a thought may be given to developing this engine fuel.

The chemical composition of wood is approximately 60 per cent. cellulose, 30 per cent. lignin, and 10 per cent. sugars and extractives. Cellulose is at present the most important part of wood from the industrial chemical point of view. It is produced in the plant by putting together in a specific way molecules of glucose. The manufacture of cellulose products has been increasing by 200,000 tons per year even during the height of the depression. Cotton, flax, and other agricultural products also contain cellulose, but wood is its most abundant, compact, and relatively cheap source. Thus, paper used to be made from cotton and linen rags until the development of the wood grinding process. To-day, ground wood pulp, made principally from spruce, hemlock, and other conifers with little resin, supplies more than three-fourths of the material of the various paper boards. The soda process, a method of obtaining pulp by caustic cooking, is used mostly for soft-fibred woods of broad-leaved species such as aspen and gum. The pulp is white, non-transparent, and is used mostly in book and magazine papers.

The acid or sulphite process was discovered by an American, but was first commercialised in Sweden. It is applied to coniferous wood low in resin content and furnishes the United States with 25 per cent. of its newsprint and book papers, more than one-third of its wrapping paper and a major part of its writing and other fine papers. The sulphate or kraft process, alkaline in character, produces strong wrapping paper and container boards from resinous woods, especially southern pines. Its manufacture constitutes at present about one-third of the total pulp production in the United States. Research has shown the way to modifications of the pulping process and bleaching methods, by which the pulp can be adapted to the production of many papers besides kraft; the results are now being applied commercially.

A multitude of other processes is at pre-



Equipment used in the chemical cooking of wood.

* From an article by R. S. Aries and J. I. Knudson in the *American Lumberman*, October 17, 1942.

sent in the development stage. Thus, the Forest Products Laboratory has been successful in a "semi-chemical" process which produces a cheap pulp from species used for newsprint up to the present. Pulp and paper is the largest single item of chemical conversion, constituting five per cent. of all the wood utilised in the United States. About 225 lb. of paper and boards are consumed yearly by every man, woman, and child in the U.S.A. By an integration of the saw mill and pulp mill, wood waste in form of limbs, tops, and trees unsuitable for timber can be used for pulping. At present these wastes should replace to a great extent the imports which, in normal times, were over two million tons annually. The task of research in furthering the production of pulp and paper from domestic material is even deeper. Higher yields and better pulp quality from native woods is desirable. Woods not used up to the present have to be utilised.

Synthetic Fibre Development

The development of cellulose synthetic fibres has been startling. From 300,000 lb. in 1911, their production increased to 350 million lb. in 1940. Present-day developments may force an even greater strain on the industry. Most of the rayon produced is made by the viscose process and 60 per cent. of it is obtained from highly purified wood cellulose, cotton linters being its chief competitor. The strength and wearing qualities of synthetic fibres decrease in proportion to the degradation or breaking down of the molecular structure of the cellulose. The efforts of chemists and engineers are therefore focussed on the modifications of the processes in order to yield high quality fibres without breaking down the cellulose molecule to any great extent.

By a process similar to the production of rayon, thin sheets of cellophane can be made. Cellulose acetate is widely used for motion-picture film as well as for moulding a very stable plastic used in aircraft, bottle caps, and a multitude of other articles. By reacting nitric acid with cellulose we obtain cellulose nitrate or nitrocellulose, the basis of many explosives. Combined with camphor, it forms celluloid. Various other plastics, lacquers, and so on, have been produced in recent years from cellulose in combination with various acids and alcohols. Beyond any doubt, research will find many new uses for this remarkable product of the forests in order to satisfy both present-day needs and the requirements of the post-war period.

In comparison with cellulose, the field of lignin chemistry is relatively unexplored. Lignin binds the cellulose fibres together in the wood. During pulping it is dissolved and generally wasted. Pulping liquors alone may supply more than 1.5 million tons of lignin annually in addition to the many million tons which may be supplied by forest and sawmill wastes. Current chemical research may transform this field into a profitable source of income to the forest products industry and each year brings us closer to this goal through the efforts of dozens of laboratories. At present lignin is used as a fertiliser, a binder for road surfaces, a linoleum paste, in electroplating (to increase the output), the production of alcohol, yeast, vanillin, and several other organic products.

Lignin Plastics

On account of its adhesive properties, excellent plastics could be made with lignin —a field which undoubtedly offers great promise. The Polyxer Chemical Company has developed a new type of resin whose lignin content can be varied in accordance with the desired properties of the final product. The resin is thermoplastic and can be made thermosetting and it is well suited for coatings and plastics. Because of the scarcity of other resins at present, resins made from wood, available in almost unlimited quantities, are of particular importance. Plastic filters containing more lignin than wood flour have also been developed in the last few years and have already been widely accepted by the industry. About 100,000 tons of filters are utilised in the United States annually, asbestos and wood flour being the most common.

Before the last war, oxalic acid was made from sawdust. Technical developments, however, made possible its cheaper synthetic production. Recently, Dr. Othmer and his co-workers at the Polytechnic Institute of Brooklyn have re-investigated the possibility of producing oxalic acid as well as acetic acid and wood alcohol from waste wood by modern chemical methods. On account of the shortage of the products obtained, this research is of vital importance in the present emergency; besides, its production will utilise profitably about 12 million lb. of sawdust.

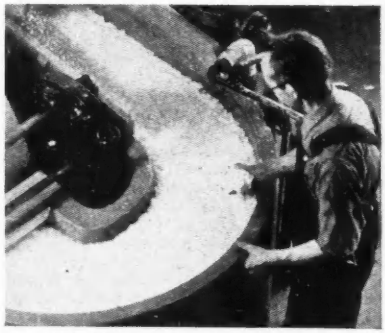
Industrial Alcohol

Several European countries now supplement their scarce food supplies by the production of sugar from wood by means of hydrolysis. The sugars can easily be converted into alcohol by the action of micro-organisms (bacteria), *i.e.*, fermentation. The manufacture of industrial alcohol is one method of utilising timber refuse on a large scale. An alcohol plant with a daily supply of 180 tons of wood can produce 4000 gallons of 190 proof alcohol at a cost of less than 10d. a gallon. Alcohol is itself vitally needed to-day, but it may be further processed into butadiene, the raw material of synthetic rubber. Thus from wood may be obtained food, alcohol, and rubber, as

the result of one and the same conversion process—hydrolysis.

Hardwood distillation is one of the oldest industries, charcoal being its earliest product. When chemistry came into the industry, it increased the yields of charcoal and recovered a multitude of other products from the vapours generated. At present the indusry produces 20 million bushels of charcoal, large quantities of wood tars, more than four million tons of wood alcohol, the equivalent of 30,000 tons of acetic acid, and many tons of activated carbon products. The wood distillation industry has been saved several times from economic strangling by the application of modern chemical engineering techniques. Wood dealers have a keen interest in the distillation of wood since the distillation industry is not concerned with either the size or quality of the wood it consumes. About 70 per cent of its raw materials can be classified as wood waste. The softwood distillation industry uses essentially light wood and stumps, its principal products being turpentine, tar oils, and rosins.

Historical records indicate that the barks of trees were a source of tanning materials for leather products among the ancients. All tannins are bitter in taste and have the property of combining with the leather to form an insoluble substance. Although science has developed chrome tanning, natural tannins still dominate the field. The industry utilises more than 300,000 cords of wood annually and more than 300 million lb. of wood extracts, of which a large portion were imported. Doubtless, the United States could be entirely self-supporting; tanners and scientists, however, have much work ahead of them before such a situation can come about.



Refining wood pulp in beaters.

Patent Law Changes

War-Time Acts and Regulations Summarised

by F. J. TEBBUTT

AT the outset of this article which explains war-time Patents and Designs law, including two Acts (1939 and 1942) and several Regulations, it should be remembered that the law of patents and designs is different from ordinary law, in that it is international, the position being that if protection is given in a country which agrees with the current Convention of the International Union for the Protection of Industrial Property, similar protection can be obtained in any other Convention country.

During a war, the Comptroller of Patents is empowered to grant licences for working enemy-owned patents, but royalties must not, of course, be paid to the enemy firm; instead they are paid over to the relevant Custodian (*e.g.*, Government officers) who retains the amount until the end of the war. In 1918, for example, moneys owing to enemy firms were set against moneys owing by enemy firms. Enemy-owned patents which were being worked under licence in 1939 can continue to be so worked, although the Comptroller can revoke or vary any such licence. An enemy firm can still apply for a patent here, but this provision is really allowed in order that licences to a home firm, as explained above, can be granted to work the patent. The foregoing provisions apply in respect of both designs and copyrights.

Time-limits play a big part in patent law but in war time, if certain things are not done when ordinarily required (*e.g.*, payment of renewal fees) the Comptroller can allow these things to be done outside these limits of time, if war circumstances are the reason for non-observance. A patent ordinarily runs for sixteen years, but extensions can be obtained by court application under two heads, one by "petition," the other by "originating summons." By the "petition" procedure, there are several prerequisites to secure an extension, the chief determining factor, however, being that the patentee has not been adequaely remunerated by his patent. By the "originating summons" procedure (roughly meaning a summons on a non-contentious matter, a court judgment being required) the Court is only required to consider whether the patentee has suffered loss or damage, or loss of opportunity to deal in or develop his

patent, through the fact that this country is at war.

Until the 1942 Act, an extension could only be for five years (exceptional cases, ten years) and only one extension could be given. Now, as regards the "war losses" provision these extension limits do not apply, and whether or not an extension has been previously given—under either of the two provisions explained—an extension can be awarded by one or more orders up to an aggregate of ten years. Ordinarily an application for an extension must be made at least six months before the patent is due to expire or, by leave of the Court, before the actual expiration date. Now, as regards the "war losses" provision, the Court can allow an application even after the expiration date, if the patentee has been prevented from applying, by having been on active service, or through other war circumstances.

The Acts and orders provide for the exchange of articles and information between this country and an ally (*e.g.*, U.S.A.) and where this has taken place, the person giving the information, etc., is not to be prejudiced as regards an application for a patent. By Defence Regulations, the Comptroller is given power to delay or restrict the publication of information in respect of an application for a patent if considered expedient in the national interest; no application for a patent in a foreign country can be made unless authorised by the Comptroller; and any person can be required to give information concerning an invention, and so forth, to certain Government departments but the person concerned by giving such information will not be prejudiced as regards an application for a patent.

Spanish Chemical Industry

Great Advance in Nitrogenous Fertilisers

From a Special Correspondent

ALTHOUGH fairly considerable quantities of Chilean nitrate are being shipped to Spain, despite increasing shipping difficulties, and contracts have been arranged for 1943, yet it can confidently be asserted that the manufacture of artificial fertilisers in Spain is probably by far the most important of recent developments in the chemical industries of that country. In some directions at all events the war has naturally proved a great stimulus in those industries. One of these must necessarily be fertilisers, of which the whole of Europe is now in urgent and imperative need. In Germany and occupied Europe much of the manufacturing capacity is diverted to munition-making, and Spain is one of the few countries left where industry can in some degree at least pursue its normal aims without the stinging lash of German imposition and dominating greed. Whilst it is yet much too early to say that home production of nitrogen fertilisers can replace the 600,000 tons annually imported, much is being done to reduce the need for imports.

Among many new nitrogenous fertiliser works may be mentioned: Saltos de Duero S.A., Nitrates de Castilla S.A., an ammonia factory in Alcañiz (Teruel province), and other new ammonia works—using coke oven gases from new iron and steel works—such as, the Sociedad Española de Fabricas del Nitrogeno in Bilbao, with a capital of 150 million pesetas, and an ammonium sulphate output of 125,000 tons per annum; also the Soc. Iberica del Nitrogeno which has recently increased its capital in order to extend its plant at La Felguera. This and one or two others should have a capacity of 60,000 tons (presumably in terms of N). Of the foregoing, the company Nitrates de Castilla (Nicas) is a subsidiary of the Duero concern, an electrochemical combine, and aims at an output also of 60,000 tons by electrolysis at Valladolid; whilst the Hidroelectrica Española, also using an electrochemical process, will add another 40,000 tons. Of non-nitrogenous fertilisers, reference may be made to an output of 200,000 tons of superphosphate at a new factory at El Pinar.

Miscellaneous Chemicals

Among miscellaneous chemical industries showing recent progress may be noted: synthetic fibres, *e.g.*, by the Fabr. Esp. de Fibras Artificiales S.A. (Fefasa) producing 10,000 tons at Miranda del Ebro from straw, to be increased ultimately to 27,000 tons; the Soc. Nacional Industrial Aplicacion Cellulosa Esp. (Sniace), interested in a process for the use of eucalyptus wood, with several other cellulose projects under consideration; new aniline works in Barcelona; tanning materials at Oviedo, including 1000 tons of tannic acid; a coal hydrogenation plant at Teruel; works in Seville for production of copper (5000 tons), sulphur (50,000 tons), and sulphuric acid (15,000 tons) from pyrites by the Soc. Esp. de Construcción Electro-Mecanica; artificial fibres from rice-, wheat-, and other straw or native materials, *e.g.*, by Cefasp at Miranda del Ebro. Much attention is being given to the cultivation of fibre plants, and to home utilisation of turpentine and rosin.

Parliamentary Topics

Palestine's Chemical Imports

IN the House of Commons last week, Mr. Henderson Stewart asked the Colonial Secretary whether he was aware of the resentment felt by independent British importers of chemicals into Palestine at the recent Order imposed by the Palestine Government requiring all importers to send shipping documents through I.C.I. (Levant), Ltd.

Mr. Oliver Stanley replied that the purpose of the Order was to ensure that sufficient and not more than sufficient chemicals were imported into Palestine. At this stage in the war the trade in scarce commodities must be controlled, and in technical matters of this kind the Government could not exercise control without expert advice and assistance. In its original form the Order was admittedly open to the objection that it might enforce the disclosure of trade secrets to rival firms, and modifications have been introduced which would, it was hoped, remove that objection. It would be understood that the I.C.I. (Levant) were not the sole importers but only the sole consignees of those goods.

Underground Gasification

Mr. W. W. Wakefield has tabled a question, which he will put to the Minister of Fuel and Power, regarding the subterranean gasification of coal. It is pointed out that over 60 years ago Ramsay had suggested a scheme by which coal could be converted to gas in its seams within the earth. The Russians had realised the possibilities and, since 1938, Russian scientists had turned the scheme to practical use.

Factory Inspectorate

In reply to a question from Mr. Rhys Davies as to whether, in view of the increase in industrial employment, he was satisfied that the factory inspectorate was adequate to prevent the violation of laws safeguarding the interests of women and young persons employed in industry, the Minister of Labour said that the authorised strength of the inspectorate had been increased by 25 per cent. since the beginning of the war. He hoped the trade unions would assist him by reporting cases affecting their members as he considered this an effective method of assisting the inspectors.

The Paint Industry

Major Lloyd asked the President of the Board of Trade whether he was aware that paint and distemper were being regularly imported into Scotland from the South, where, for a long time, intruding firms had been fostering depots and branch factories to the detriment of old-established Scottish firms, which were now threatened with concentration. Mr. Dalton replied that the arrangements for the paint industry were under review, and that licences which, in the case of certain firms were to have expired on December 31, had now been extended for two months.

The Minister of Supply was asked by Mr. R. Morgan whether he was aware that two German refugees who arrived in this country shortly before the war had been allowed to build a paint factory with the aid of a Government subsidy, and that they now had a nucleus certificate, and why he was subsidising foreigners in preference to British citizens. In answer, Sir A. Duncan said he understood that the two firms mentioned were established before 1939 and that one of them received, under the Special Areas (Amendment) Act, 1937, some slight rebate of rent and rates for a limited period, which expired over a year ago. The Ministry of Supply had not given any subsidy to either firm.

Lactic Acid

Sir E. Graham-Little asked the Minister of Supply why the Miscellaneous Chemicals Control had refused supplies of lactic acid for the manufacture of lactic sugar for medicinal purposes, although it was not in short supply and was available for other purposes. Mr. Peat replied that applications had been made by only one firm, and that after consultation with the Ministry of Health these had been rejected as the available supplies of lactic acid were required for other and more essential purposes.

BRITISH STANDARDS LIBRARY

The range of British Standards is now so diverse, and the number of war emergency issues so large, that no printed list of standards can be up-to-date. Latest information regarding the issue of new and revised British Standards, of which there are at present over a thousand, can be obtained from the B.S.I. Library at 28 Victoria Street, Westminster (open 10 to 5, Monday to Fridays; at other times by appointment). The B.S.I. Library also contains a large selection of specifications prepared by the standards bodies in Australia, New Zealand, South Africa, Canada, U.S.A., Argentine, Sweden, France, Germany, etc. Extracts from specifications may be made, if desired, and copies of the overseas specifications may be borrowed.

A complete set of British Standards is maintained also by the great national libraries, the principal university libraries, and the central public reference libraries in Birmingham, Cardiff, Leeds, Manchester, Middlesbrough, Newcastle-on-Tyne, Nottingham, and Sheffield.

Magnesium from Magnesite*

Development of Electrothermic Reduction Process

THE United States Bureau of Mines began a study of the various methods of producing magnesium metal from magnesites in 1936. At that time the present need for expansion of the industry had not yet been felt; the study was prompted by the desire to establish a new metallurgical industry in the North-West for utilising surplus power from the Bonneville and Grande Coulee hydro-electric projects. When the need for the expansion of the industry in connection with the war became apparent, the original programme was expanded to include other processes and to investigate the methods of producing magnesium oxide from low-grade magnesites and dolomites. At the beginning of this work, a study of various magnesium processes indicated that the most promising field for research was the electrothermic reduction of magnesium oxide by carbon. The original experimental scheme was drawn up to study and improve processes of this type.

Continuous Process

After extensive small-scale experimental work on the various operations of reduction, shock-cooling and distillation, a continuous process was developed which is described as follows: Magnesite ore is concentrated by flotation to yield a product containing not less than 45 per cent. MgO and not more than 1.5 per cent. SiO. This is calcined in a rotary kiln to produce a calcine containing not less than 90 per cent. MgO. The calcine is mixed in a rod mill with 23 per cent. low-ash carbon. The mixture is fed automatically into an arc furnace at a controlled rate and reacts to form magnesium vapour and carbon monoxide. These products issue at high velocity through an orifice into the shock-cooling flue, where they encounter an atomised spray of light fuel oil. Evaporation of a large part of the oil cools the furnace gas from 2000°C. to less than 200°C. almost instantaneously.

The rate at which oil is supplied is so regulated that the unvaporised portion is just sufficient to form a fluid suspension of the metal condensate. This regulation is controlled automatically by the temperature of the cooled products. The solid products consist of magnesium metal, magnesium oxide, carbon, silicides, and carbides of the ore impurities intermixed with liquid oil. The vapour phase is composed of oil vapour and carbon monoxide plus some hydrogen and methane resulting from the thermal dissociation of the oil.

The solid condensate and liquid oil are separated as a sludge from the oil vapour and gaseous products in a centrifugal separator of special design. The oil vapour is afterwards condensed in a water-cooled scrubber, and the lighter fractions are recovered in refrigerated coils. The exit gas contains about 50 per cent. CO, 30 per cent. hydrogen, and 20 per cent. methane. These have a fuel value about equal to that of the dissociated oil. The sludge condensate flows by gravity from the separator and is pumped to the two-stage distillation furnace, in which the oil and magnesium are recovered separately by distillation. The oil thus recovered, combined with the oil previously condensed in the scrubber, is recirculated through the spray nozzle.

The oil-distillation unit includes a horizontal retort electrically heated to 500°C. The sludge is recovered through this retort in pans attached to a pair of chains. The oil vapours are swept from the retorts to a water-cooled condenser by a current of hydrogen circulated through the gastight system. The small amount of hydrogen lost through leakage is replenished by cracking of the oil. The removal of oil from the sludge leaves small, dry, porous cakes containing about 50 per cent. magnesium metal. These briquettes drop out of the pans into a hopper from which they are fed into cages. The charged cages completely fill a horizontal, alloy-steel retort, heated by electric resisters to 1000°C. The magnesium metal evaporates from the briquettes, and the vapour is carried by a current of hydrogen to a condenser, from which the molten metal is tapped. Movement of the cages through the retorts and their return to the feed are accomplished by a ram and drag-chain mechanism, both of which operate outside the heated zone. The charging of briquettes, discharging of residues, and all movements of the cages are accomplished automatically.

Satisfactory Results with Oil

Although continuous and uninterrupted operation of the pilot plant has not yet been attained, the results that have been obtained show that it is practicable to use oil or liquid hydrocarbons as shock-cooling medium. Oil has been found to be as effective as gas for shock-cooling magnesium vapour when atomised in a nozzle of proper design. At the same time it offers many advantages that make the equipment re-

* From an article by H. A. Doerner, W. Floyd Holbrook, E. Don Dilling & Dwight L. Harris, of the Metallurgical Division, United States Bureau of Mines, Pullman, Washington, (*Chem. Met. Eng.*, *34*, 8, 85.)

quired smaller and less expensive and permits safer and simpler operation.

A satisfactory grade of oil for the purpose is light stove oil. Only 25 lb. of such oil has a cooling effect equal to approximately 1000 cu. ft. of gas. The total vapour of gas and oil vapour per lb. of magnesium is about 150 cu. ft. at atmospheric pressure at a temperature of 180°C. For shock-cooling with gas, the total volume of exit gases under the same conditions is more than ten times greater. This difference in volume of the gaseous product represents considerable difference in the size and cost of equipment for handling the gas and separating it from the condensates. Furthermore, since the condensate from the reduction furnace is protected from oxidation by the oil, the hazards and problems with handling a pyrophoric substance are, in large part, eliminated.

The following data represent an average for operation of a unit.

Capacity, lb. Mg per hr.	7.11
Conversion, per cent.	76.8
Power consumption, kWh. per lb. Mg ..	12.3
Oil consumption, lb. per lb. Mg.	0.75
Electrode consumption, lb. per lb. Mg. ..	0.18
MgO in condensate, lb. per lb. Mg. ..	0.50
Carbon in condensate, lb. per lb. Mg ..	0.62
By-product gas (CO,H_2,CH_4), cu. ft. per lb. Mg	26.50

Development of the two-stage continuous distillation process has not yet progressed to a point where a full-sized commercial unit could be designed. Operations of this unit had to wait successful operation of the reduction unit, so that development has been slower. The distillation operation involves a number of problems of design and heat transfer that become increasingly complex as the capacity of the unit increases, making it necessary to attempt only gradual development of successively larger units. From experience with the small distillation unit, it seems likely that a unit could be developed that would have a capacity of 100 lb. of metal per hour with an energy input of 150-200 kW. Assuming a radiation loss of 10 per cent., it is estimated that this unit would require 0.57 kWh. for the oil distillation and 1.16 kWh. for magnesium distillation, a total of 1.73 kWh. per lb. of metal produced.

Further work is being carried out to investigate a new type of distillation operation, which is expected to permit considerable increase in capacity.

Canadian chemists have replaced cotton and silk in the making of cordite and in containers by substituting wood pulp from Canada's forests. Wood pulp is used for the guncotton in the explosive, while the cartridge bag and igniter disc, used to wrap and fire the cordite, which were formerly made of pure silk, are now woven of artificial silk derived from wood pulp.

Tellurium Determination

New Method for Lead and Antimony-Lead Alloys

As the addition of small percentages of tellurium as an alloying element imparts valuable frost-resisting properties to lead water-pipes, its accurate determination is a necessity and any improvement on existing methods is desirable. A method described by Dr. B. S. Evans in the *Analyst* (67, 801, p. 387) claims the following advantages: (a) the low factor $Te\text{-}TeO_2$, using $N/100$ iodine for titration; (b) visible separation of the tellurium—especially desirable in dealing with an unknown material; (c) the general simplicity of the procedure.

The separation of the tellurium is based on an observation that lead and tellurium will dissolve completely when heated with syrupy phosphoric acid; this treatment alone results in the loss of most of the tellurium, presumably as hydrogen telluride, but if the sample is first attacked with dilute nitric acid, the phosphoric acid then added and the whole heated until all nitric acid has been driven off, a clear syrupy liquid is obtained without loss of tellurium. This liquid is taken up with a small amount of water and dilute hydrochloric acid is added, which precipitates the bulk of the lead. The precipitate is filtered off, giving a filtrate in which the tellurium can be directly precipitated with sodium hypophosphite. The presence of antimony involves no change whatever in the procedure.

EXPLOSIVE RIVETS

Explosive rivets, introduced a year ago to break one bottleneck in aircraft production, are now speeding field repairs of damaged planes in America. A plane with a gash in its wing or bullet holes in its fuselage can be patched quickly without any dismantling by using these rivets, state Du Pont de Nemours, reported by the *Iron and Coal Trades Review*. Repairs which formely required days are now completed in a few hours.

This new type of rivet has a high explosive contained in a cavity at the end of the shank. Heat applied to the rivet head by an electric gun detonates the charge. The explosion expands the charged end of the shank, forming a " blind " head and setting the rivet. The whole operation is performed from one side. Explosive rivets are installed by one workman at a rate of 15 to 20 rivets a minute, as contrasted with two to four a minute for most " blind " fasteners. These rivets are made of aluminium alloy and weigh only about one-fourth as much as generally used " blind " fasteners.

Personal Notes

CAPTAIN J. A. BENN, director of Benn Brothers, Ltd., proprietors of THE CHEMICAL AGE, has accepted an invitation to join the board of the United Kingdom Provident Institution.

MR. J. A. RUSSELL, commercial manager of Dorman, Long & Co., Ltd., is retiring on December 31, and will be succeeded by MR. A. MACLEOD. Mr. Russell has had 50 years' experience of the iron and steel trade, and his services will remain at the disposal of the company.

MR. ALBERT CORKER, director and general manager of the Midland Iron Co., Ltd., Rotherham, retires from the position of general manager as from January 1, 1943, and is succeeded by MR. ANTHONY J. WAINFORD, who before the war was district representative of Thomas W. Ward, Ltd., on the North-East Coast, and later Ministry of Supply Officer in that district.

DR. ROBERT E. WILSON, who is a director of the American Chemical Society, as well as being president of the Pan-American Petroleum & Transport Co., the American Oil Co., etc., has been selected to receive the Perkin Medal of the Society of Chemical Industry for 1943. The medal will be presented on January 8 at The Chemists' Club, New York.

Obituary

MR. ANDREW HAMILTON BAIRD, head of the well-known Edinburgh firm of scientific instrument and chemical dealers, which he founded 55 years ago, died in Edinburgh, aged 80, on December 5.

SIR HERBERT BLAIN, C.B.E., M.Inst.T., who died at Burgess Hill, Sussex, on December 16, aged 72, was founder of the London Safety First Council, and founder and past president of the National Safety First Association, now the Royal Society for the Prevention of Accidents.

New Control Orders

Non-Ferrous Metals

THE Control of Non-Ferrous Metals (No. 11) (Copper, Lead and Zinc) Order, and the Control of Tin (No. 5) Order, issued by the Ministry of Supply, both came into force on December 17.

The No. 11 Order (S. R. & O. 1942, Nos. 2534, 2535, 2536, price 3d.) modifies the provisions controlling the acquisition or sale of copper, lead, and zinc, and of ores, concentrates, and specified scrap containing these metals, it having been found necessary to provide a closer control over the use of the metals. The most important modifications are that: (i) persons who consume not more than 1 ton of any of these metals per month are no longer exempted from the licensing procedure; and (ii) additional classes of scrap and waste containing these metals are, for the first time, brought within the scope of the licensing procedure. As hitherto, it will not be necessary for a scrap merchant to obtain a licence for the acquisition of scrap which he subjects to no process other than cleaning, crushing, or sorting. The new Order maintains the present scale of maximum prices for copper, lead and zinc, and the existing premiums and discounts.

Under the new Control of Tin Order (S. R. & O. 1942, No. 2532, price 1d.) persons acquiring no more than 1 cwt. of tin a month who have been hitherto exempt from the licensing procedure, will now have to obtain a licence before acquiring any quantity, however small.

Bichromate Prices

The Ministry of Supply has issued the Control of Bichromate (No. 2) Order, 1942, increasing maximum prices of commercial grade sodium bichromate and potassium bichromate by ¾d. per lb. The Order (S. R. & O. 1942, No. 2547) came into force on December 17.

Benzol Plant

A Ministry of Fuel and Power Order (S. R. & O. 1942, No. 2505) makes it obligatory for coke producers to have all gas produced by carbonisation of coal treated by passing through plant for the recovery of benzol. The method must extract to the fullest capacity of the plant the crude benzol in the gas so as to yield the maximum amount of toluene therefrom. This Order is directed to owners of benzol plant, whereas an additional Direction (S. R. & O. 1942, No. 2506) imposes similar obligations on public utility undertakings. Both Order and Direction come into force on January 1.

Tins, Cans, etc.

The Control of Tins, Cans, Kegs, Drums, and Packaging Pails (No. 9) Order (S.R. & O. 1942, No. 2507), which came into force on December 21, varies the previous Orders (Nos. 5 to 8) in the same series by restricting still further the materials which may be packed in containers of tinplate, tinned sheet, terne plate, terne sheet, lead-coated sheet, and galvanised sheet.

Toilet Preparations

The principal items of interest in the new Toilet Preparations Order (S. R. & O. 1942, No. 2605) are that the manufacture of hair preparations containing petroleum is prohibited except under licence and that no toilet preparation containing more than ½ per cent. by weight of the following materials may be manufactured except under licence: acetone, butyl alcohol, butyl acetate, ethyl acetate, amyl acetate, amyl alcohol, and methanol.

Scottish Acid Strike Ends

Difficulty over Allotment of Coupons

A STRIKE which arose in connection with the issue of clothing coupons to men working on the acid plant of a Scottish Royal Ordnance factory was ended after two days, as a result of a meeting between Mr. W. Hannington, national organiser of the Amalgamated Engineering Union, the shop stewards, and workers' representatives in the factory. After discussion, the shop stewards' committee agreed to recommend the men to return to work, but insisted that their claim be granted within 21 days—an attitude which was unanimously endorsed by the men concerned.

The men's side of the Whitley Council had the responsibility for allocating the coupons, but as the total supply at their disposal amounted to only ten coupons, they could not increase the supply to one section of men without reducing the supply to the others. The men on the acid plant claimed that, in spite of the issue of protective clothing, the acid penetrated and rotted their underwear, and they demanded extra coupons. The management agreed to approach the Ministry of Supply and see whether a revision of the number of coupons was possible.

PACKAGING RESEARCH

A five years' programme of research into packaging problems is to be carried out by the Printing and Allied Trades Research Association. It will cost the industry £10,000 a year, and Government financial support has been conditionally promised through the D.S.I.R. Experience has shown that foodstuffs and other vital merchandise must be suitably packed to keep out moisture, to seal in flavour, or to prevent contamination. Much work has been done by manufacturers' laboratories to discover alternative war-time packaging materials. The new plan will help to co-ordinate these research programmes, and by concentrating work at a central laboratory will prevent waste of scientific personnel and help Britain's post-war merchandising.

Leading companies endorsing the plan include Lever Bros. and Unilever, Ltd.; Imperial Chemical Industries, Ltd.; Metal Box Co., Ltd.; and British Cellophane, Ltd.

A scientific liaison bureau has been established by the Federal Government in Australia, under the control of the Minister in Charge of Scientific and Industrial Research, Mr. Dedman. A full-time director and departmental liaison officers would be appointed, and panels of non-Government scientists would be formed to establish contact with Government laboratories, etc.

Unusual Crane Accident

No Hood Over Gears

AN unusual accident was described to Mr. Horatio Lane at Birmingham Police Court last week. A workman in the factory of Henry Wiggin & Co., electric wire and nickel manufacturers, climbed the ladder of a crane, but when he reached the pinnacle the crane started to move. The man, thrown from the ladder, caught a leg in the travelling gear and lacerated the limb so badly as to make long confinement necessary in a hospital. An inspector of Factories submitted that a hood over the gears would have prevented such an accident. Mr. Bourke urged there had been a breakdown of the human element in a factory which had an impressive record of 100 years. Between the two submissions, Mr. Lane said that perhaps, for an infringement of the Factory Act, justice would be met with a nominal fine of £10.

CASEIN GLUE

A revision of the specification for casein glue for aircraft purposes has just been issued as B.S. 4.V.2. The revision of this specification became necessary owing to the difficulty in obtaining walnut test slips which were specified for carrying out the strength test. As a result of research work carried out by the Forest Products Research Laboratory, it was found that beech slips could be used as an alternative. The details of the test have been modified and the design of a suggested apparatus for assembling the pieces for test is also included. Copies of this revision may be obtained from the British Standards Institution, 28 Victoria Street, London, S.W.1, price 1s. 3d. post free.

HUNGARIAN OILS

A new process has been discovered for the extraction and utilisation of asphalt oil from the bituminous deposits at Derna-Tartaros and Bodnos in the district of Bihar (Hungary). These contain between 10 and 20 per cent. of asphalt oil which has penerated the stone. A heavy crude lubricating oil is produced by treatment with benzene, benzol, or other solvent, and this may be processed further to yield equal parts of lubricating oil and asphalt suitable for road construction. It is claimed that the oil can be blended to advantage with that obtained from other Hungarian mineral oils. A commercial plant is to be ready for production within twelve months.

General News——From Week to Week

To mark the tercentenary of the birth of Sir Isaac Newton, a wreath of laurel leaves was laid on Sunday on his tomb in Westminster Abbey by Sir Henry Dale, president of the Royal Society.

The Audley Engineering Co., Ltd., of Newport, Shropshire, announce that their Mr. P. Meredith has returned to reopen their office in the London area at 36 Ormerod Avenue, Hampton, Middlesex (Tel.: Molesey 3183).

Under the recent Consumer Rationing (No. 16) Order, 1942 (S. R. & O. 1942, No. 2434) the range of industrial overalls available at specially reduced coupon values is extended to include those made of the new Utility Overall Cloths, numbered 3118 and 3119.

A new centrifuge has been installed in the laboratory of the Regional Blood Transfusion Service headquarters at Leeds, whereby the output of serum for the Royal Navy has been increased from 80 litres a week to about 180 litres.

In order to save still more paper—100,000 tons are urgently needed—business firms are asked to make a special comb-out of old files, ledgers and out-of-date reference books and to give for salvage all old records which can possibly be dispensed with.

Two mobile canteens have been presented to the employees of Imperial Smelting Corporation, Ltd., by the employees of their Australian associates—Broken Hill South, Ltd., the Electrolytic Zinc Co. of Australasia, Ltd., North Broken Hill, Ltd., and the Zinc Corporation, Ltd.

All the leaders of the Scottish Highland development bodies have shown the greatest satisfaction at the report of the Hydro-Electric Development Committee, which they regard as being the first step in a major policy of industrial development in the Highlands.

Probably the first instance of echo-sounding as an aid to chemical research was reported recently, when four Cambridge scientists used this method for locating seaweed deposits on our Atlantic coasts, with a view to utilising the weed in the production of chemicals.

The importance attached to the service being rendered to the nation by miners is shown by the fact that young men between the ages of 18 and 25 may, when they register on becoming available for general service in the forces, choose underground mining as an alternative to military service. Young volunteers, 1500 of whom are required by March, will receive several months' training under the supervision of experienced miners before going to the actual coal face.

The Army Dental Corps has a laboratory in Leeds which is, in effect, a small factory making artificial teeth for soldiers and members of the A.T.S. An interesting experiment is the making of dentures from a form of acrylic plastic. Vulcanite will become short as rubber supplies decrease.

The Christmas number of "600 Magazine," the staff magazine of George Cohen, Sons and Company, Ltd., has 80 pocket-size pages crammed with an accumulation of information, jokes, and cartoons which does credit to the energy and sustained good humour of its contributors and compilers.

Rhodes, Brydon & Youatt, Ltd., Waterloo Engineering Works, Stockport, have published a very handy and attractively produced desk diary (price 1d.) illustrated by pictures of British waterfalls. All proceeds of the sale of this will be devoted to the British Red Cross fund.

In view of the new technique of fire-fighting made necessary by new types of incendiary bombs, the Ministry of Home Security has withdrawn the reports issued in connection with official tests of a number of proprietary fire-extinguishing liquids whose efficiency depends on their direct application to the bomb at close quarters.

At the annual meeting of the Delagoa Bay Development Corporation, Ltd., in London, the chairman, Mr. W. L. Castelden, said that the most remarkable expansion during the past year had been in the demand for industrial power to meet the requirements of the producers of vegetable oils, and the exploitation of native timbers by the local saw mills.

Foreign News

Sodium light is being used in America for surface inspection by microscope. It is found to be efficient in the detection of pits, cracks, and flaws in metallic materials.

The recovery of fatty materials from waste waters is being encouraged by the Vichy Government, who have asked firms with experience in the construction of suitable plant to report to the authorities.

French production of power alcohol will not increase this year, but for 1943 an expansion by 20 per cent. is hoped for as a result of the increase of the acreage under sugar beet.

Salt production in Bulgaria, at present 8000—10,000 tons per annum, is to be raised within the next few years to 50,000 tons. The existing works have been nationalised and are operated under the directions of the Ministry of Agriculture.

A party of economic experts, headed by Mr. R. Herbert, of the raw materials department of the Ministry of Supply, has gone to French North Africa to study the requirements of the area. Special attention will be devoted to procuring raw materials such as iron ore and phosphates.

Hawaii has revived crude rubber production after a lapse of 31 years, announces Reuter. The trees were last tapped in 1911, the high cost of labour and the fall in rubber prices having caused the failure of the company concerned. The new enterprise is expected to yield 50,000 lb. a year.

The setting up of copper reserves intended for national industrial purposes was considered at Santiago last week at a meeting presided over by Chile's Minister for Economy. Representatives of the Anaconda Copper, Chile Exploration, and Andes Mining companies took part in the discussions.

Synthetic rubber is to be produced in Rumania by a newly-formed company, "Rompren," equipped with the comparatively small capital of 5,000,000 lei. The company, the second of its kind in the country, is to use a process developed by Professor Nemitkul in a refinery placed at its disposal by the Petrolina oil company.

A plant for processing linseed oil and soya-bean oil is about to be established at Hamilton (Ontario) by Sir Walter Carpenter, it is announced. Sir Walter's copra plant at Vancouver is being turned over to linseed processing also, and it is expected that all the Carpenter plants will be able to handle 1½ million bushels of linseed in the coming season.

Japanese-made fibres and textiles, processed from soya beans, and received in Australia just before the outbreak of war, have been released for display at Sydney Technological Museum. The Curator of the museum said he would not apologise for the display, as it might serve to make the Australian wool industry realise what it would be up against after the war.

Titaniferous bauxite has been located in fair quantity in Jashpur State, Chota Nagpur, India, by Mr. A. K. Dey. Percentage of aluminium oxide varies between 51 and 60, while the titanium oxide content is sometimes as high as 14 per cent. The chief occurrences, however, are far from any railway, and the nearest important town is Ranchi, 100 miles to the east.

Volume 17 of the *Journal of the Electrodepositors' Technical Society* has just been published. The *Journal* contains the proceedings of the Society, including the reproduction of papers, with diagrams and illustrations, which have been presented during the session 1941-42. Reference to a number of these has appeared in our columns. The price to members is 15s., and to non-members one guinea.

Scarcity of steel in Sweden has led to the development of a new type of stainless steel thread for surgical purposes. It is claimed that the new thread can be sterilised without detriment and that it is stronger though less "plastic" than silver thread, and medical opinion is quoted to the effect that the steel thread should not be regarded as a mere substitute, but that it has come to stay, being in some respects superior to silk and catgut.

Production of arsenic in Brazil is now increasing. Up to 1939 it was very irregular, but since that date the situation has improved, and, in 1941, production reached 1203 metric tons. At present it is produced by three companies which work the gold deposits in the state of Minas Geraes: the St. John del Rey Mining Co., in Nova Lima (much the largest), the Cia. Minas da Passagem, near Mariana, and the Cia. Brasileira de Mineraçao, in Juca Vieira.

A well-known French scientist, M. Henri Laugier, testifying before a Congressional Committee in Washington, complained that full use was not being made of scientists. He gave a list of 30 leading French scientists now in the U.S., not one of whom was employed, despite the shortage of experts there. M. Pierre Cot agreed with M. Laugier that France's failure to use her scientists was a major element in her weakness.

The constitution of the Council appointed by the Government of India to co-ordinate the activities of the Board of Scientific and Industrial Research and the Industrial Research Utilisation Committee has been announced. Mr. N. R. Sarker is appointed president, and the other members are representative of the principal interests of industry and science in India. The Council will administer the Industrial Research Fund which it has been decided to constitute in India.

Forthcoming Events

The London section of the **Society of Chemical Industry** will meet jointly with the Food and Plastics Groups at the Royal Institution, Albemarle Street, W. 1, at 2.30 p.m., on **January 4,** for the Jubilee Memorial Lecture, which will be given by Professor E. K. Rideal, who will speak on "Catalytic Hydrogenation."

A meeting of the Edinburgh and East Scotland Section of the **Society of Chemical Industry** will be held at 7.30 p.m. on **January 8,** at the North British Station Hotel, Edinburgh. Professor R. H. Hopkins, D.Sc., F.I.C., will speak on "Some Recent Advances in Biochemistry Applied to Brewing."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Satisfaction

IGLODINE CO., LTD., Newcastle-on-Tyne, manufacturing chemists. (M.S., 26/12/42.) Satisfaction December 5, of debentures registered February 1, 1917, to the extent of £535.

Company News

Imperial Smelting Co., Ltd., announce a profit of £235,895 (£298,842) for the year ended June 30.

The Lautaro Nitrate Co. announce a net profit, for the year to June 30, of £556,178 (£590,890).

The Electrolytic Zinc Co. of Australasia, Ltd., announce a net profit of £303,916 (£362,784) for the year to June 30.

British Emulsifiers, Ltd., announce a profit, for the year to September 30, of £24,770 (£3543). A dividend of 12½ per cent. has already been paid.

L. Dennis and Co., Ltd., Thorpe Chemical Works, Walkden, Manchester, have increased their nominal capital by the addition of £10,000 beyond the registered capital of £35,000. The additional capital is divided into 10,000 6 per cent. non-cumulative preference shares of £1 each.

New Companies Registered

Ken Chemical Company, Ltd. (377,827).—Private company. Capital: £100 in 100 shares of £1 each. Manufacturers of and dealers in oils, chemicals, glues, varnishes, etc. Directors: K. E. White, F. J. Bell. Registered office: 2 Guildhall Street, Preston, Lancs.

A. S. Blackman (Precision Engineers), Ltd. (377,725).—Private company. Capital: £2500 in 2500 shares of £1 each. Precision, constructional, electrical and chemical engineers, tool makers, etc. Directors: A. S. Blackman; B. Babain. Registered office: 45 Chancery Lane, W.C.2.

Clarke's (Wholesale), Ltd. (377,797).—Private company. Capital: £100 to 100 shares of £1 each. Manufacturing, research, dispensing and analytical chemists, manufacturers of and dealers in dyes, paints, plastics, greases, etc. Directors: R. Grimley; S. Heywood; C. P. Tatham. Registered office: 30 Park Row, Nottingham.

Chas. H. Stone, Ltd. (377,796).—Private company. Capital: £100 in 100 shares of £1 each. Merchants, importers, exporters, manufacturers and factors of and dealers in raw materials for the soap, varnish, paint, chemical and allied trades, manufacturers of and wholesale and retail dealers in seed and vegetable oils, turpentine, resins, chromes, oxides, solvents and waxes, etc. Director: Chas. H. Stone. Registered office: 66 Finsbury Pavement, E.C.2.

Chemical and Allied Stocks and Shares

WITH the near approach of the end of the year, business in Stock Exchange markets has shown further contraction. Nevertheless, the general tendency has been steady in the continued absence of selling. In fact, securities of all classes remained firmly held. British Funds tended to move higher, sentiment having been assisted by the vesting of South African loans, expectations being that the bulk of the money arising from this will be reinvested in gilt-edged stocks. Shares of chemical and kindred companies reflected the steadiness of markets and were quite well maintained on balance for the week, while individual features of interest have not been lacking. For instance, rather more attention continued to be given to shares of companies connected with plastics. At the time of writing, Thomas De La Rue have further improved, business having been recorded up to 88s. 6d. Erinoid 5s. ordinary were dealt in up to 10s. 6d., while British Industrial Plastics 2s. ordinary transferred up to close on 5s., and Lacrinoid Products around 4s. 4½d.

In other directions, Barry & Staines were marked down to 34s. 9d. following their recent advance, the market having been disappointed with the absence of an interim dividend. Nairn & Greenwich, however, remained at 56s. 3d., awaiting the financial results, due shortly. Fisons were around 41s., and B. Laporte again firmly held and quoted at 71s. 3d. "middle." Moreover, elsewhere, there was again rather a more active appearance in Goodlass Wall 10s. ordinary, dealings in which have ranged from 12s. 6d. to 12s. 10½d. at the time of writing. Richard Thomas 6s. 8d. ordinary attracted attention around 8s. 7½d. on continued market talk of the possibility of an interim dividend.

Comparison of current prices with those ruling at the beginning of 1942 show that shares of chemical and kindred companies have recorded further improvement during the past twelve months. This must, of course, be read in relation to the general trend in Stock Exchange values, and not as indicating hopes of better dividends. In most cases, owing to the effect of E.P.T. and the difficulties attaching to war-time conditions, there will be satisfaction if it is possible to maintain dividend payments. Imperial Chemical, 36s. 3d. at the time of writing, were 33s. 3d. at the beginning of 1942. There is general confidence in the market that the dividend is likely to remain

on an 8 per cent. basis. During the same period, Borax Consolidated deferred have moved up from 30s. 6d. to 34s.; Lever & Unilever from 30s. 6d. to 33s. 3d.; British Aluminium from 45s 3d. to 48s. 9d.; and British Oxygen from 67s. 6d. to 71s. 3d.

In the case of the units of the Distillers Co., the rise on balance for the year has been substantial (from 74s. 6d. to 84s. 6d.) sentiment having been governed by the strength of the balance-sheet, expectations that there seem reasonable possibilities of the dividend being kept at 16¼ per cent., and wider realisation of the company's diversified interests, some of which are playing an important part in the war effort. In other directions, United Molasses, which were 31s. 6d. at the beginning of the year, are now lower at 29s. 1¼d. In the same period, rather sharp fluctuations have been shown in Triplex Glass 10s. ordinary units, but on balance for the year, the price is little changed at 30s. 10½d., compared with 31s. 3d. Among other widely-held shares, Boots Drug are now 38s. 3d., compared with 36s. 3d. a year ago; Turner & Newall 73s. 3d. compared with 70s. 1½d.; Murex 101s. 3d. compared with 92s. 6d.; and Tube Investments 89s. 9d. compared with 86s. 6d. During the past twelve months, Courtaulds have risen from 35s. 9d. to 45s., and British Celanese 10s. ordinary from 7s. 9d. to 16s. In 1942, good gains were recorded by leading oil shares, "Shell" having risen on balance from 55s. 7½d. to 64s. 4½d., and Anglo-Iranian from 50s. to 78s. 9d.

British Chemical Prices

Market Reports

TRADE in general chemicals continues to pursue an active course and steady price conditions characterise nearly all sections of the market, with a firmer tendency noted in some instances. A fair amount of fresh inquiry is reported, while deliveries against contracts are proceeding along normal lines. Items such as caustic soda and bicarbonate of soda are receiving a good inquiry and limited offers of yellow prussiate of soda and chlorate of soda are finding a ready outlet. There is practically no change to report in the position of the potash products and the demand in this section continues to be in excess of available supplies. Values in nearly all sections of the coal-tar products market remain firm. The demand for both crude and crystal carbolic acid continues strong, while creosote oil is in good request.

MANCHESTER.—To some extent, trading conditions on the Manchester chemical market during the past week have been under the influence of the approaching holidays, fresh business having presented no features of any consequence. There is not likely to be much slowing down of contract deliveries during the next week or so apart from the slackening associated with the approach of holiday breaks at consuming works, and sellers in most sections are anticipating a generally steady movement of supplies. Meanwhile, price conditions are steady to firm throughout the range. In the tar products section, fresh business has been only moderate, but contract supplies are being taken up satisfactorily.

GLASGOW.—In the Scottish heavy chemical trade, home business has shown a slight improvement during the past week. This is, no doubt, on account of the nearness to the holidays at the New Year. Export trade is still very restricted. Prices generally remain very firm with a tendency to rise at the turn of the year.

Price Changes

Potassium Bichromate. — Crystals and granular, 7¾d. per lb.; ground, 8¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Sodium Bichromate.—Crystals, cake and powder, 6¼d. per lb.; anhydrous, 6¼d. per lb., net, d/d U.K.

University Chemistry

Research Work in Britain and the U.S.

PROGRESS in chemical research carried out recently at universities in the United Kingdom and in the United States of America is recorded in two small volumes of reports that have recently come to hand.

The first of these is entitled "Chemical Kinetics and Natural Products" and is an account of the University of Pennsylvania Bicentennial Conference. Published in Philadelphia by the Pennsylvania University Press it is circulated in this country by the Oxford University Press (price 3s. 6d.). The second of the volumes referred to consists of the Abstracts of Dissertations Approved for the Ph.D., M.Sc., and M.Litt. degrees in the University of Cambridge during the academic year 1940-41; and though, of course, it covers a wide range of subjects, an important part of the total is devoted to chemistry: of 118 pages of text 20 pages are occupied by chemistry proper, while biochemical papers fill another dozen pages.

In the Pennsylvanian volume three papers are contained: "The Photochemistry, Fluorescence, and Spectroscopy of Certain Polyatomic Molecules," by Professor W. Albert Noyes, Jr., D.-ès-Sc.; "The Kinetics of Contact Catalysts and the Industrial Background," by Professor Hugh S. Taylor, D.Sc., LL.D.; and "The Chemistry of the Ergot Alkaloids," by Dr. Walter A. Jacobs, Ph.D. A quotation from the second of these gives a graphic notion of

the present-day American attitude towards research chemistry and industry.

"America can face the intense competition that rages in this field (petroleum and plastics chemistry) with equanimity. Thanks to her universities and the large bodies of trained personnel which they have turned out, American chemical industry finds itself in a vastly more favourable position, to-day, when national emergency once more confronts her, than 25 years ago. During this quarter of a century the industry has grown from the tiniest of infants to a giant, has seized the initiative from all competitors and potentially can outstrip them all. Side by side with the intensive industrial developments here outlined there has grown up also in industrial research, governmental, and university laboratories a broad programme of theoretical study.

"Upon the pioneering investigations of Langmuir has been built a body of theoretical fundamental knowledge, the major contributions to which have come from American laboratories, and with the aid of which a more rapid and certain approach to the solution of problems of industry can be achieved. Later researches revealed that two types of association of a gas with a surface, the one physical the other chemical, could obtain, and that the operating temperatures determined which type of interaction occurred. With different surfaces, different temperature ranges could be employed. The range of catalytic materials and the temperature ranges in which they operate were correspondingly expanded.

"With the advent of isotope separations, signalised by Urey's discovery of heavy hydrogen, new tools became available for the study of the associations with surfaces involved in catalytic changes. To-day, the analysis is going yet deeper. Twenty-five years ago the science of catalysis was almost purely empirical, dependent entirely on trial and error. Now, the chemistry of reactions at surfaces has become a highly refined scientific study, rich in possibilities for applied science."

PATENT SPECIFICATIONS ACCEPTED

Manufacture of synthetic resins.—E. I. du Pont de Nemours and Co. (May 20, 1939.)* 8928.

Manufacture of synthetic resins.—E. I. du Pont de Nemours and Co. (July 18, 1939.)* 11844.

Catalytic dehydrogenation and aromatisation.—Standard Oil Co., and M. W. Kellog Co. (Sept. 13, 1939.)* 14081.

Prevention of caking or setting of ammonium nitrate or ammonium nitrate compositions.—E. I. du Pont de Nemours and Co., T. W. Hauff, and H. H. Holmes. Sept. 21, 1940. 14429.

Manufacture of dyestuffs and dyestuff intermediates.—J. D. Kendall and D. J. Fry. Oct. 16, 1940. (Sample furnished.) 15358.

Process of making electrical sheets of silicon steel.—W. P. Williams (Armco International Corporation). Oct. 17, 1940. 15408.

Manufacture of polymeric materials.—E. I. du Pont de Nemours and Co. (Oct. 18, 1939.)* 15423.

Mixing-apparatus.—E. I. du Pont de Nemours and Co. (Oct. 19, 1939.)* 15424.

Treatment of siliceous material and the manufacture of glass.—N. S. Garbisch. (Nov. 29, 1939.)* 15518.

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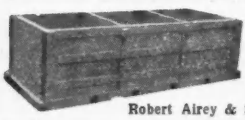
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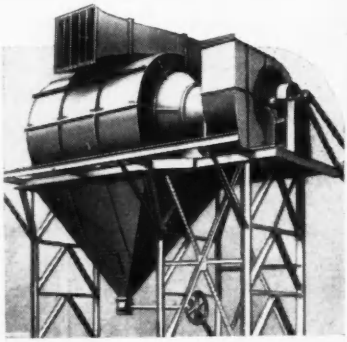
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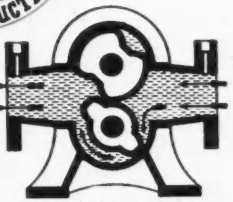

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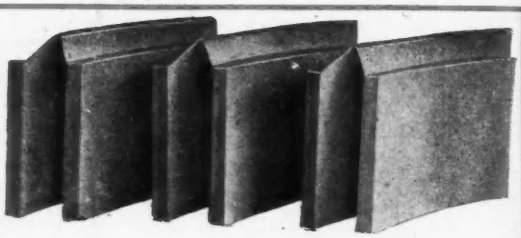

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